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Distribution of Grain Handling and Transportation Costs of Prairie Farmers 1977/78 - 1995/96

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Canada

The Distribution of the Grain Handling and Transportation Costs of Prairie Farmers From 1977/78 to 1995/96

A Report to The Committee of Inquiry on the Crow Benefit Payment

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PREPACE

In the winter of 1984/85, the Freight Studies Division of the Research Branch conducted, to assist the Committee of Inquiry on Crow Benefit Payment, several research studies into various aspects of the grain handling and transportation industry. As requested by the Committee, the Research Branch delayed publishing its work until the Committee had had adequate time to inform the Minister of Transport of its recommendations. We are now releasing for public information and comment and to contribute to informed public discussion several reports which describe our studies. This document presents some relatively unique information on the out of pocket expenses a typical grain farmer on the Prairies has incurred and may incur to get his export grain to port terminals. It is important that the reader note the delivery points and branchlines mentioned in this report were chosen strictly for purposes of illustration and should not be misconstrued as being indicative of government intentions regarding network rationalization.

The interested reader is encouraged to obtain also the previous publication in this series, titled P.H.A.E.R.: AN OVERVIEW. That report presents a review of PHAER, the Producer Haul and Elevator Receipts information system, and summarizes the diverse research for which PHAER was used in past years. The uniqueness of PHAER is due to the special attention given to integrating farm production, trucking cost, elevation service and rail service components into an analytical model that is based on actual deliveries made by farmers to country elevator locations. That publication is intended for a broad audience and is meant to provide general information about the PHAER system. Thus, much technical and methodological detail has been placed in appendices. The document is being made available at this time in the format of a working paper for the purpose of stimulating timely communication and comment.

Any conclusions and opinions should not be interpreted as the position of the Canadian Transport Commission, or any of its Committees. Research Branch publications cited herein may be requested from the Publications Division, CTC, Ottawa K1A-0N9. Questions or comments regarding this report should be addressed directly to R.L. Baldwin or A.W. Gemmell, Freight Studies Division, at 819-997-6541.

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TABLE OF CONTENTS

		Page
	SUMMARY OF FINDINGS	1
I	INTRODUCTION AND ACKNOWLEDGEMENTS	3
II	OBJECTIVES	4
III	METHODOLOGY	5
	1. Sample Frame and Study Areas Selected	8
	2. Railway Operating Cost Model	9
	3. Impact of Inflation	15
IV	COST ESTIMATION RESULTS	16
	1. Historical Distribution of Costs to Farmers	16
	2. Forecast Distribution of Costs to Farmers	19
	3. Crow Benefit Forecast	26
APPENDICES		
	1. Assumptions Used in Cost Models	32
	2. Study Areas Characteristics	33
	3. Summary of Cost and Traffic Inflation Factors	41
FIGURES		
	1. Schematic Description of PHAER EXTENTION	6
	2. Summary of PHAER Costing Methodology	7
	3. Map of Manitoba Study Area	10
	4. Map of Saskatchewan Study Area 1	11
	5. Map of Saskatchewan Study Area 2	12
	6. Map of Alberta Study Area	13

Page

7A. Comparison of Average Farmer's Out of Pocket Costs and Railway's Operating Cost by Crop Year (6.78% inflation) 30

7B. Comparison of Average Farmer's Out of Pocket Costs and Railway's Operating Cost by Crop Year (3.39% inflation) 31

TABLES

1. Rail Unit Operating Cost Assumptions 15

2. PHAER Database Sample Area Statistics 17

3. Historical Cost Distribution 18

4A-4B. Forecast Cost Distribution at 6.78% Inflation 21

4C-4D. Forecast Cost Distribution at 3.39% Inflation 23

5. 1995/96 Cost Distribution Alternatives 26

6A. Rail Operating Costs at 6.78% Inflation 28

6B. Rail Operating Costs at 3.39% Inflation 28

7A. Estimated Crow Benefit at 6.78% Inflation 29

7B. Estimated Crow Benefit at 3.39% Inflation 29

SUMMARY OF FINDINGS

The purpose of the research described in this report was to determine for the Committee of Inquiry the historical and future magnitude of costs, as the typical prairie farmer perceives them, for trucking, elevator handling and rail transportation of grain destined for export. The P.H.A.E.R. system was used to identify a representative sample of farms in the population and derive cost estimates for this sample. Furthermore, estimates of the Crow Benefit as a farmer might see it have been developed as an interesting by-product of this work. Following are the main conclusions one can draw from this research.

1. The forecast of farmer costs, their level and rate of increase, are heavily influenced by the assumed growth rate in grain shipments and the growth rate in elevator and railway operating costs. Shipments are predicted to grow 28% from 1981/2 to 1995/6 and operating costs are expected to rise 6.78% per year.

2. The average farmer in the Prairies paid out about $382 per thousand bushels in 1981/2 to move his grain to port. This was split between trucking costs, elevation and Crow tariff charges in the ratio of 14:56:30 or $52, $212, and $117 respectively.

3. By 1995/6 this total cost will rise and average between $1876 and $1680 depending on whether general cost inflation has a 6.8% or 3.4% growth rate. This means the split will become 6% - 7% for trucking expenses, 28% - 20% for elevation expenses, and 65% - 73% for railway haul charges. Note this assumes there will be no increase in shipments over their 1981/2 level.

4. If the forecast 28% rise in total grain shipments does occur it has been estimated to have several impacts: while total costs will rise no more than 17%, to $2 188 instead of to $1 876 per kilobushels the average cost of elevation will drop from $533 to $468 per thousand bushels and this will mean there will be about a 7% shift in costs out of elevation and into

railway haul charges. In other words, the distributions stated in 3 above for elevation and trucking costs are the maximum. The 28% higher shipments will lower the elevation cost proportion from the 28%-20% range to the 21%-13% range and raise the WGTA tariff cost from the 65%-73% range to 72%-80% range.

5. The difference between the WGTA tariff cost to the farmer and the railway's operating cost, a local form of Crow Benefit, is predicted to drop from $681 per thousand bushels in 1981/2 to $44 by 1995/6. This assumes the rate of general inflation should be as low as 3.4% during the intervening years; and is primarily due to the predicted eleven-fold rise in the WGTA tariffs over the period of 1981/2 to 1995/6. The rate of decline in the 'Crow Benefit' is sensitive to these two forecasts and the rate of increase of grain machines shipped. For example, the benefit will disappear as of 1995/6 if there is as little as a 4% cumulative increase in shipments. Furthermore, as little as a 10% cumulative increase in shipments over 1981/2 levels by 1990/1 would cause WGTA revenues to equal railway operating costs by 1990/1. Such modest increase, in shipments are definitely feasible. The reader is advised to consult the text of the report in order to understand the basis for the estimates referenced above.

Readers who may be more comfortable with units of dollars per tonne can convert any dollar per thousand bushels estimate quoted herein to approximate $/tonne by dividing by 25.

I. INTRODUCTION AND ACKNOWLEDGEMENTS

The Research Branch of the CTC has prepared for the Committee of Inquiry an analysis of the Prairie farmer's costs for grain handling at country elevators and the transportation of grain which can be shipped under the statutory freight rates of the Western Grain Transportation Act or its predecessor, the Crows Nest Pass Freight Rates Agreement.

In order to achieve that objective many people and organizations contributed input under pressure of close deadlines because the Committee itself had to function within narrow time limits. The following grain companies provided valuable data and insight on their industry: Alberta Wheat Pool, Saskatchewan Wheat Pools, Manitoba Pool Elevators, Pioneer Grain Co., and the United Grain Growers Co. In the C.T.C. the Railway Transport Committee staff provided essential advice regarding railway operational costing and economics and the C.T.C. Traffic and Tariffs Branch provided statutory tariff detail. Several Commission staff, specifically A. Gemmell, M. Cairns, J. Kruger, R. Thivierge, C. Phillips and B. Hennessey provided, through their advice and diligent effort, the support which resulted in this analysis being available to the Committee in a timely manner. The Research Branch appreciates and thanks all participants for their contributions.

II OBJECTIVES

The purpose of this research was to determine the magnitude of the grain handling and transportation costs the typical farmer confronts on the Prairie for moving his export grains to port. The transportation element is actually the sum of two components: 1) the producer's expenses for trucking statutory grain from the farm to the country elevator at a railway serviced delivery point and 2) the expenses the farmer pays to ship that grain by railway through to the port terminal. Costs to farmers throughout this report will always be defined as the farmer's out-of-pocket expenses. Estimates are provided of these costs for two recent crop years in order to define an historical basis for such costs and their relative proportion; further, cost forecasts have been developed for several future crop years according to assumptions and criteria previously discussed with the members of the Committee of Inquiry. This report will describe in turn: the methodology employed to develop cost estimates, the basic assumptions involved, the forecast constraints that were required in the preparation of the estimation work described herein, and finally the historical and future cost estimates in "average dollars per thousand bushels" shipped and in "percentage of total cost" terms.

The research conducted for this report uses recent enhancements to P.H.A.E.R. created as part of the ongoing Research Branch program of development of its grain handling and transportation information systems. More specifically, this document includes estimates of railway company revenues likely to be generated under the Western Grain Transportation Act tariff, as well as estimates of the railway operating cost. The two in combination permit derivation of the magnitude of a "Crow Benefit", disaggregated closer to the farm level than was previously possible.

III METHODOLOGY

The Research Branch has an established computer-based information and analytical capability generally referred to as P.H.A.E.R., the Producer Haul and Elevator Receipts system. A full description of information holdings, analytical methods and PHAER applications experience is available in a separate CTC publication.[1] This project made extensive use of analytical software referred to as PHAER EXTENTION; its function in the context of this project can be briefly summarized as follows. The analyst can access historical records for farms and delivery points by defining to the PHAER database inquiry system grain delivery points farms used, then estimate the private trucking, elevation and railway service-related cost by farm and in average dollars paid per thousand bushels.[2] A flowchart rendition of this approach is illustrated in Figure 1. The process of estimating the component costs is illustrated in Figure 2: 'Summary of PHAER Costing Methodology'. Note that this refers entirely to cost analysis from the farmer's viewpoint and out-of-pocket costs. The principal input to the analysis was the total grain volume each farmer delivered to a licensed elevator during the crop year of interest. This volume and the location of farm and elevator are known quantities and when put into the models described in reference 1 and Figure 2 allow calculating the total costs the farmer will incur over the crop year 1) to move his grain to an elevator; 2) for his share of elevator operating costs, and 3) for his rail-related expenses.

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1 Gemmell, A.W., P.H.A.E.R.: An Overview, December, 1984, Ottawa, Freight Studies Division, Research Branch, C.T.C.

2 Bushels are the common unit since the database goes back to the early nineteen seventies.

FIGURE 1

SCHEMATIC DESCRIPTION OF PHAER EXTENSION

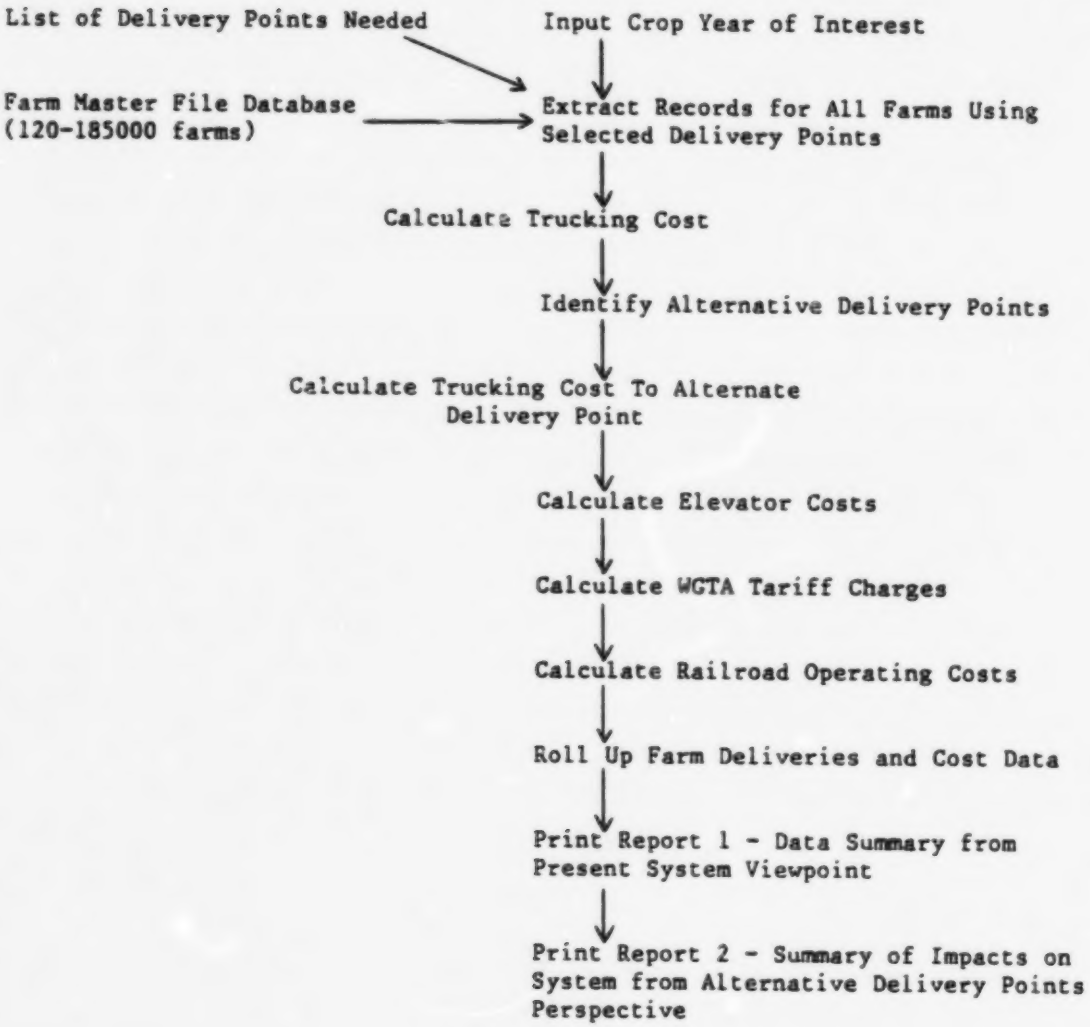

List of Delivery Points Needed
Input Crop Year of Interest
Farm Master File Database (120-185000 farms)
Extract Records for All Farms Using Selected Delivery Points
Calculate Trucking Cost
Identify Alternative Delivery Points
Calculate Trucking Cost To Alternate Delivery Point
Calculate Elevator Costs
Calculate WGTA Tariff Charges
Calculate Railroad Operating Costs
Roll Up Farm Deliveries and Cost Data
Print Report 1 - Data Summary from Present System Viewpoint
Print Report 2 - Summary of Impacts on System from Alternative Delivery Points Perspective

Figure 2

SUMMARY OF PHAER COSTING METHODOLOGY

TOTAL COST TO FARMER = Sum of 1 to 3 Below

1. PRIVATE TRUCKING COST per farm =

   (total BUSHELS delivered to an elevator)

   X (Haul DISTANCE to the elevator)
   X (petroleum PRICE INDEX) X (MILEAGE related sum of unit operating COSTS)

   + (wage PRICE INDEX) X (hourly weighted sum of unit LABOR COSTS)
   + (general PRICE INDEX) X (sum of several miscellaneous unit operating COSTS)

2. ELEVATION COST per farm =

   (general PRICE INDEX)

   X (farmer's total BUSHELS delivered to the elevator)
   X (incremental COST of his bushels on total elevator operating cost)

   + (farmers share of total FIXED COSTS and OVERHEAD ALLOCATED COSTS of that elevator)

3. WGTA TARIFF COST per farm =

   (total BUSHELS delivered by farm)

   X (statutory TARIFF applicable)
   X (Crow MULTIPLIER for the crop year forecast)

Notes:

1. In the elevation model the forecast of the general price index (GDP) has major influence; in the trucking model it is a relatively minor factor and only one inflation factor of four.

2. 'X' means multiply by.

The farmer's expenses for rail service can be precisely estimated by multiplying his total annual deliveries to an elevator by the Crow tariff, or the WGTA tariff, appropriate for that delivery point and year in question.

His trucking expenses are estimated by putting his haul distance and volume data into a cost model which is basically an accounting equation of the average unit operating cost of a truck. Unit costs are from a CTC survey study of truck operating cost experience conducted in 1982 for a large sample of bulk haul trucks.

Elevation expense estimates are derived from an elevator operating cost model rather than a revenue model for the following reasons. The farmer's cost is actually the product of his delivery volume and the net tariff per bushel charged by the elevator for service; the net tariff varies daily and between elevators and delivery points. We have no data on these tariffs and thus cannot, nor should we, link it with our annual data on total farm deliveries. Instead PHAER uses a model of elevator operating costs which as a proxy for elevator revenues will give more stable and reliable predictions on an annual basis. Given that there is significant competition between grain companies, one expects profit margins are kept low, and thus their total operating cost on a per bushel delivered basis will be 'nearly equivalent' to the actual net tariff paid per bushel, i.e., the farmer's out-of-pocket cost for elevation service. For crop years prior to 1982 the cost model is a regression equation based on a sample of over 350 elevator expenditure experiences; estimates beyond 1982 use an equation based on over 1 200 elevator financial reports for crop year 1982/83.

1. Sample Frame and Study Areas Selected

The PHAER database covers 125 000 to 185 000 farms depending on the crop year. As it is expensive and time consuming to develop cost averages using a 100% sample, sample areas of significant size were identified which have exhibited farm and elevator grain traffic characteristics typical of each province. Figures 3, 4 and 5 illustrate, by the railway lines high-

lighted, the location of the study areas chosen as sample frames for cost estimation purposes in each province.

Appendix 2 contains tables which describe the selection criteria and compare the statistics of the study area with the provincial totals/averages. The study areas are highly representative of the farmer population in each province and presumably costs estimated for the sample farms will accurately indicate the provincial averages.

2. Railway Operating Cost Model

We have refined the railway operating cost estimation method to: 1) incorporate explicitly cost inflation assumptions, and 2) include the factor that the railway cost of servicing an elevator is heavily influenced by the relative proportion of branchline and mainline haul distances. Regarding 1), this has been done by installing exogenous variables for inflation indices. Regarding 2), delivery points that have a longer branchline haul relative to other delivery points which are closer to mainlines will have proportionately higher rail costs. Including this factor allows estimating the incremental cost to the railway of serving certain hinterland elevators. Of course, these estimates are approximations only; the reader must note the method and the estimates themselves quoted herein are not to be taken as official positions of the Commission or particularly the Railway Transport Committee and staff.

The RTC costing specialists were consulted regarding the methodology used here. After considering the scope of the research and its purpose, and the costs necessary to improve the predictive accuracy of this estimate, the specialists did not expresss serious objection to the branchline and mainline related unit operating costs derived by Freight Studies staff.

FIGURE 3

NAPINKA & LA RIVIERE CP

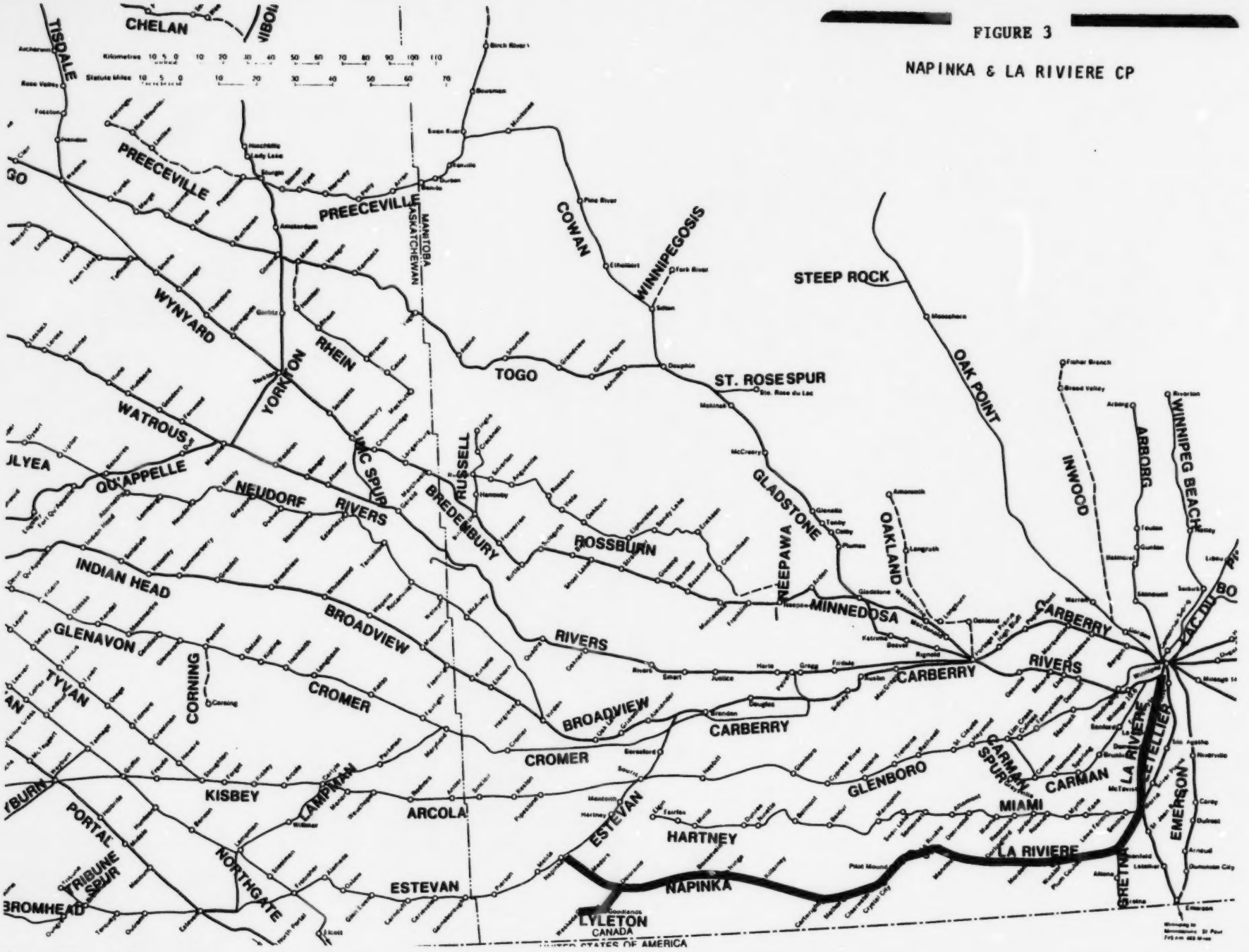


FIGURE 4

MANTARIO, WHITE BEAR & ELROSE CN

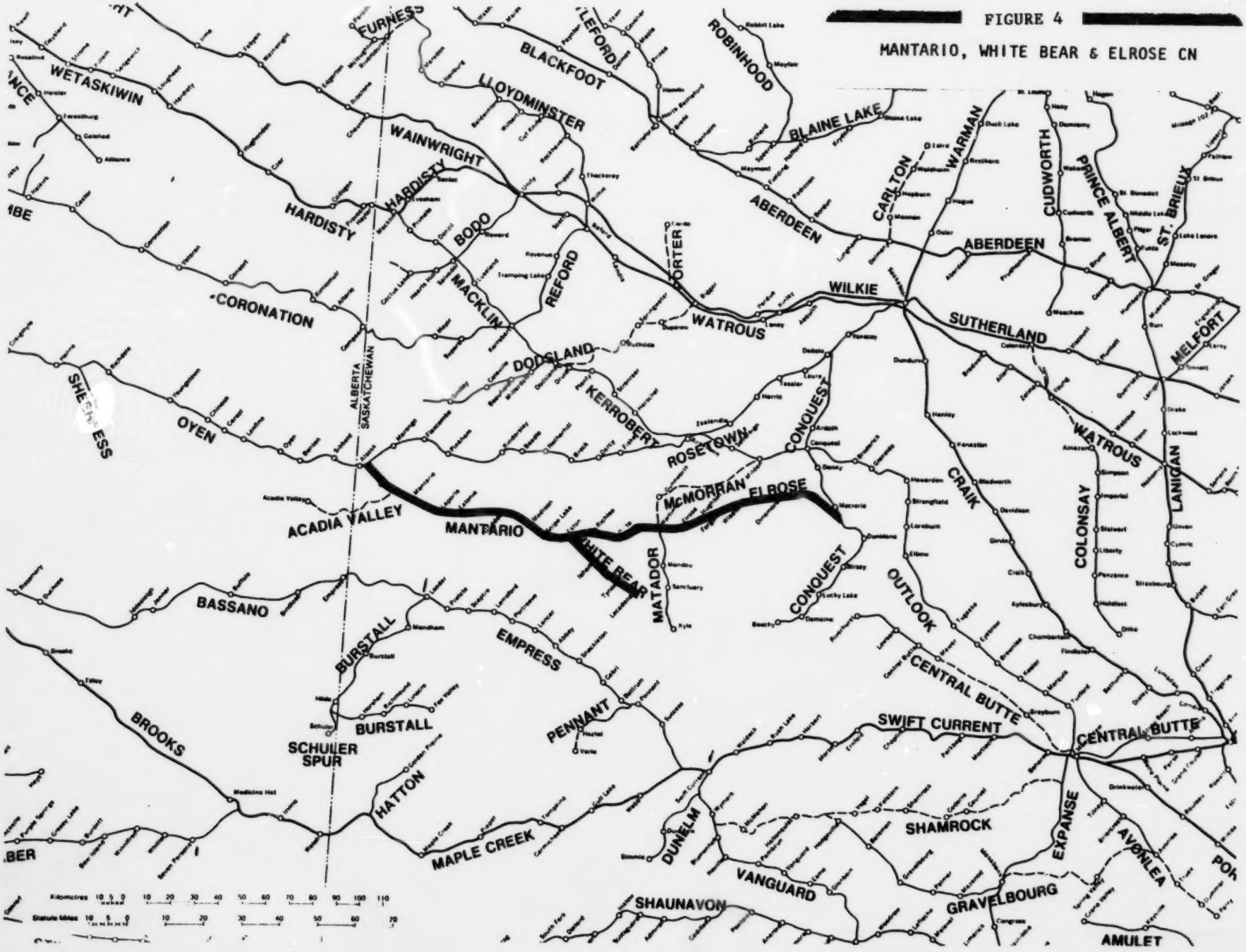


FIGURE 5

MACKLIN & KERROBERT CP

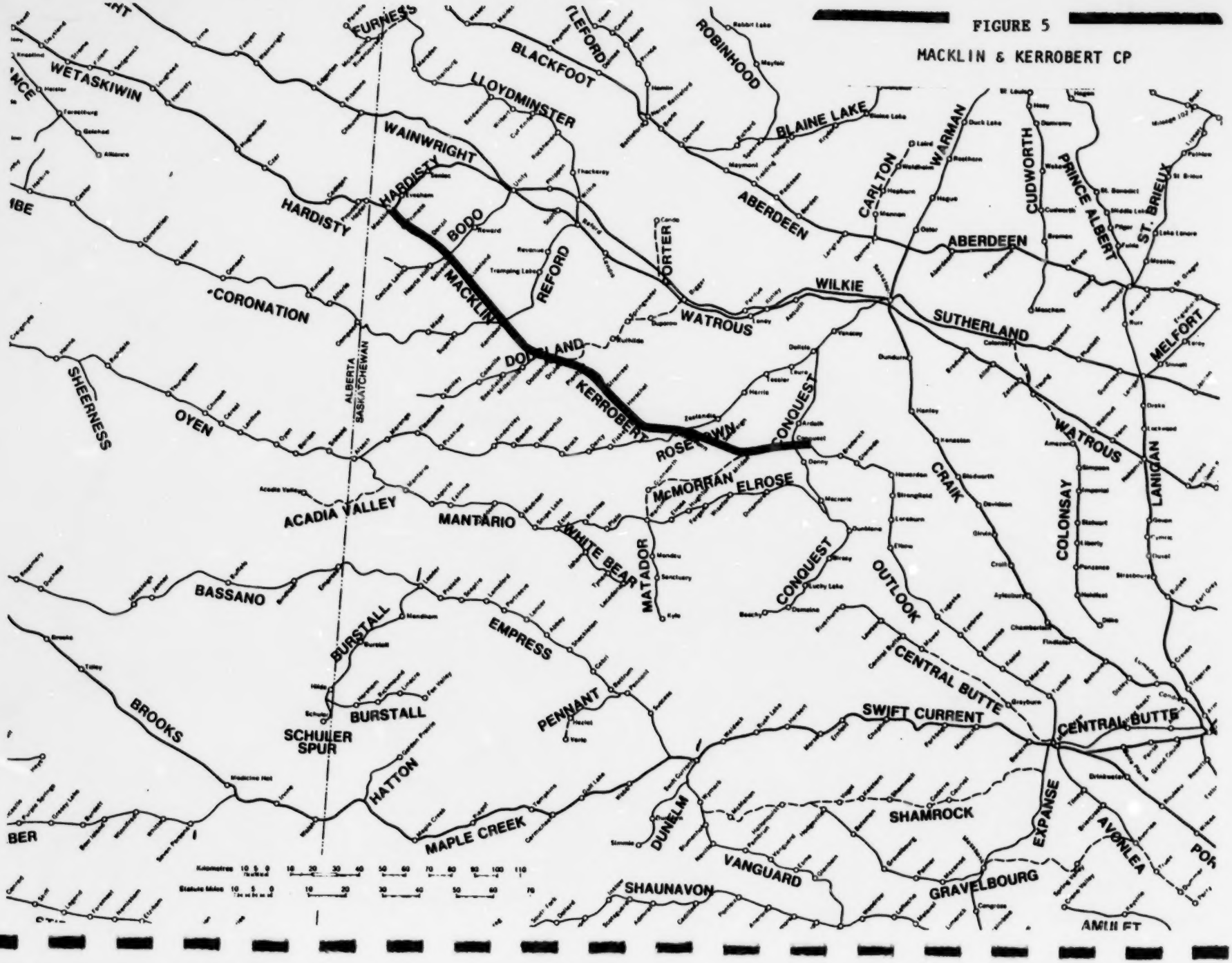
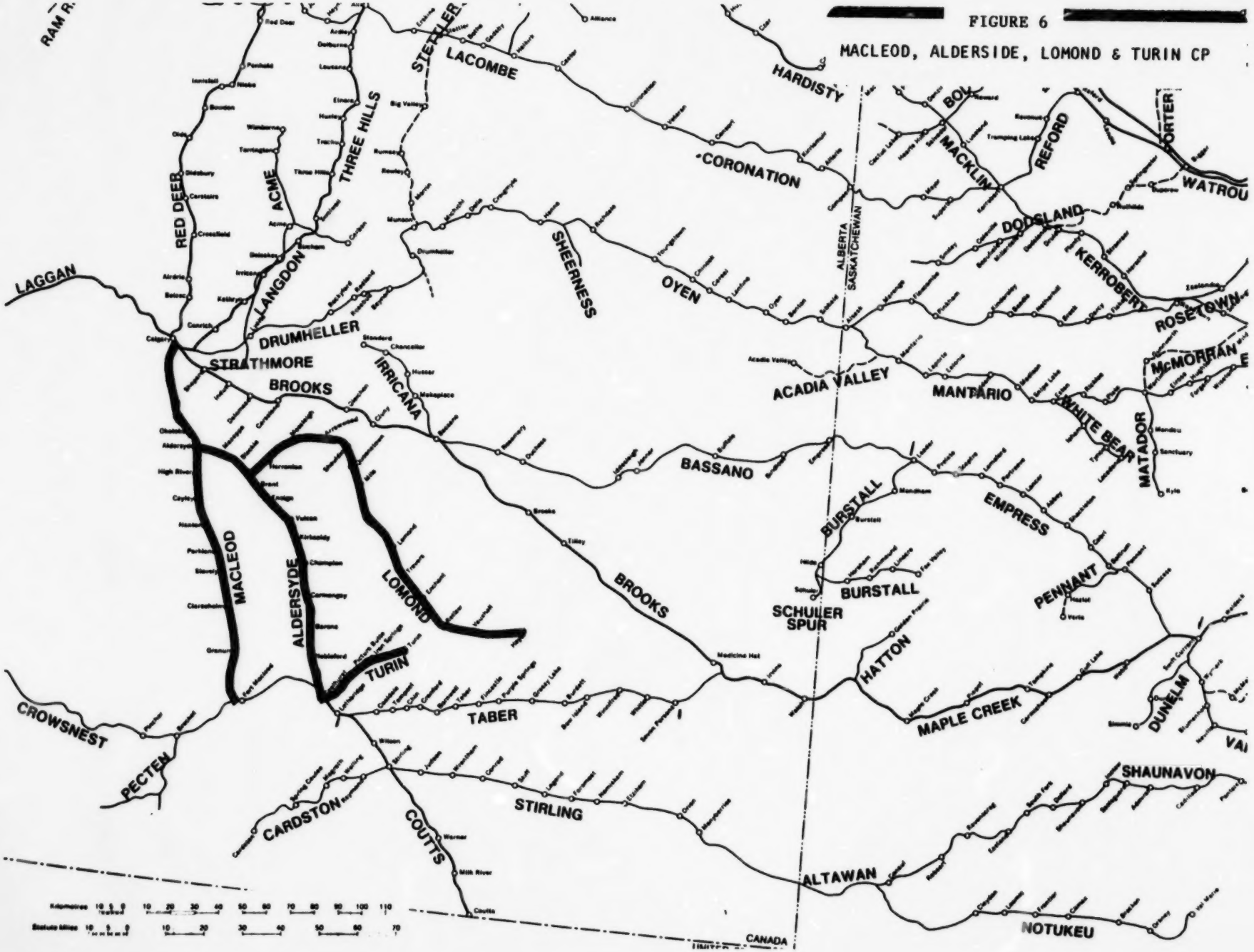


FIGURE 6

MACLEOD, ALDERSIDE, LOMOND & TURIN CP



The following formula summarizes the railway operating cost simulation methodology. The unit costs mentionned are specified below in Table 1.

RAIL OPERATING COST AND CREW BENEFIT ESTIMATION METHOD

1) R.O.C. = (GDPI) * (Bushels Delivered) $\star$
(BLM1) $\star$ (UOCBL) + (MLM1) $\star$ (UOCML)

2) C.B. = R.O.C. - WGTA Revenue

Where R.O.C. is the railway operating cost, BLMI and MLM1 are the branch line and main line haul distance from elevator to port, UOCBL and UOCML is the unit operating cost to move a bushel one mile on a branchline and mainline, and GDPI is the general cost inflation index. C.B. is the Crow Benefit estimate.

It should be pointed out that railway operating cost is prorated to each farm on the basis of proportion of delivered grain volume at an elevator, that costing is done on a delivery point and not on an elevator basis and that the model is sensitive to the general cost inflation forecast assumption.

TABLE 1

RAIL UNIT OPERATING COST ASSUMPTIONS
(in cents per bushel mile)

Crop Year	Unit Operating Cost Average Branchline	Mainline
Up to 1980/1	.10	.04
After 1980/1	.29	.05

Source: Freight Studies, Research Branch

3. Impact of Inflation

The influence of inflation on costs and prices has been made explicit throughout PHAER. Separately controllable variables on each cost component are available to allow the analyst to input various cost index forecasts where necessary. Appendix 3 describes in detail the grain shipment forecast, the resultant WGTA tariff forecast (labelled the Crow Multiplier), and the individual inflation factor forecasts used in this report. Several external, reliable sources provided forecasts; these sources are identified in Appendix 3 footnotes. Truck price and wage index forecasts only were prepared interually by Freight Studies staff after fitting a variety of trend equations to appropriate time series data from Statistics Canada. Conservative forecasts were selected for each index.

It was agreed with the Committee of Inquiry at the outset of this research that the assumptions about forecasts of growth in traffic and WGTA tariffs would be coordinated with Agriculture Canada in order to simplify the task of the Committee in interpreting and correlating analyses provided by various departments. The forecast of the Western Grain Transportation Act tariff was provided by Agriculture Canada; underlying it is their official forecast to 1995 of total grain production and Prairie shipments.

The reader will note the forecast rate of growth of costs/prices in general, that is the Gross Domestic Product inflator, is included in most PHAER cost modules. The initial forecast we used was provided by Transport Canada and had a 7.5% per year trend over the 1977-1996 period and 6.78% forecast over 1982/3 to 1995/6. Since elevation and rail operating cost models are sensitive to this inflator (the GDP price index) we have included in our analysis estimates of the cost distribution if general inflation should be more moderate at 3.39% per year over the forecast period of 1982 to 1995/6. That is half the inflation rate originally provided. These inflation assumptions have lead to cost distribution estimates which set a range, a minimum and maximum, within which the actual future costs will fall.

IV COST ESTIMATION RESULTS

1. Historical Distribution of Costs to Farmers

On the basis of data in the PHAER farm databases it was found that for the crop year 1977/8, 8 559 farms were in the four study areas and delivered 61.3 million bushels. Average haul by truck was 8.6 miles and farms delivered an average of 7 162 bushels.

In crop year 1981/2, 8 352 farms used the 57 delivery points in the four study areas to deliver 61.76 million bushels. Average truck haul was 8.9 miles one way and the average farm delivered 7 395 bushels during the year.

Table 2 provides detailed information on the variation in farm count, haul distance and average delivery volumes per farm in each study area.

The above-referenced delivery factors produced the cost estimates shown in Table 3. During 1977/8, the farmers total handling and transportation costs average $302 per thousand bushels (kilo-bushel). In percentage terms the total cost was distributed between trucking, elevation and rail tariff charges as 12%, 49%, and 39% respectively. The Prairie averages quoted are simple averages of the data on the four study areas. In 1981/2, the farmers each paid on average a total of $382 per kilo-bushel; they paid $52 for trucking, $212 for elevation and $117 per kilo-bushel for rail service under the Crow rates. In percentage terms the trucking cost 14% of the $382 total, elevation 56% and rail charges 30%. In contrast, the cost to the railway companies to haul this grain to port terminals was $798 per kilo-bushel; thus the Crow Benefit was $681 per thousand bushels hauled.

TABLE 2

PHAER DATABASE SAMPLE AREA STATISTICS

STUDY AREA	MAN.	SASK. 1	Sask. 2	Alta.	Total
- Total Number of Farms on PHAER Files:					
1981/2	2444	1499	1017	1820	6780
-Total Number of Farm-Elevator (origin/destination) pairs:					
1977/78	3275	1759	1297	2228	8559
1981/82	3064	1703	1338	2247	8352
-Average Truck Haul Mileage per Trip:					
1977/78	8.0	11.0	7.3	8.1	8.6
1981/82	9.2	10.5	7.8	8.0	8.9
-Average Cost of Annual Total Bushels Delivered per Farm:					
1977/78	4863	7913	7978	6095	6712
1981/82	5882	7268	6286	10213	7412
-Railway Subdivisions Involved:	Napinka Lariviere	Macklin Kerobert	Mantario Wh. Bear Elrose	Lomond Macleod	
-Total Delivery Points These Farms Used in 1981/82:					
	15	10	10	22	27

Notes: 1. Prairie averages are not weighted.

TABLE 3

HISTORICAL COST DISTRIBUTION
(average $ per kilo-bushel)

STUDY AREA	PRIVATE TRUCKING	ELEVATION & HANDLING	WGTA TARIFF	TOTAL COSTS
Manitoba				
-1977/78	34	132	93	259
-1981/82	54	192	93	339
Saskatchewan Area 1				
-1977/78	42	128	130	300
-1981/82	60	207	130	397
Saskatchewan Area 2				
-1977/78	31	146	137	314
-1981/82	48	240	137	425
Alberta				
-1977/78	34	193	108	335
-1981/82	48	210	108	366
Prairie Average (not weighted)				
-1977/78	35	150	117	302
-1981/82	52	212	117	382
Percentage Distribution of Prairie Averages				
-1977/78	12%	49%	39%	100%
-1981/82	14%	56%	30%	100%

2. Forecast Distribution of Costs to Farmers

Assuming the 1985-1995 forecasts of inflation factors mentionned above, holding as constant the grain delivery volumes and patterns actually experienced in crop year 1981/82 and assuming no significant change in cropping, we developed the forecast of grain handling and transportation costs shown in Tables 4A and 4C. The former, and its companion Tables 4B are based on general inflation occurring at a rate of 6.78% per year; Tables 4C and 4D are based on the 3.39% scenario.

Tables 4A and 4C illustrate cost in terms of average dollars spent per kilo-bushel while 4B and 4D show those costs in 'percentage of total' terms.

As Table 4B indicates in 1981/82 the distribution between trucking, elevation and rail was 14%, 56%, and 30% of total whereas by 1995/96 their relative magnitudes will represent 6%, 28%, and 65% of total costs given a 6.78% inflation trend. This redistribution will be due to: 1) the 10.6-fold rise in WGTA tariffs which is a result of the forecast growth of shipment volume, shipping costs and shippers share of costs, and 2) the 2.5-fold rise in elevation costs.

In contrast, under the 3.39% inflation assumption, the 14:56:30 distribution of 1981/82 would shift to a distribution of 7% for trucking, 20% for elevation and 73% for rail service in 1995/96.

The Agriculture Canada forecast of shipments under statutory rates predicts shipments will rise 28% by 1995/96 over 1981/82 experience; this includes all statutory grains. But note that because of a limitation in the PHAER methodology each redistribution estimate above is based on assuming all farms will deliver in 1995/96 the **SAME** volumes they did in 1981/82. Thus, the forecast 6:28:65 distribution reflects the impact on **ONLY** those farmers who do not increase their shipments 28% by 1995/96.

Further, the forecast of WGTA tariffs in all scenarios are fixed at a level appropriate to cover shippers share of costs given the shipment volume forecasted by Agriculture Canada. This simplification of the WGTA TARIFF REVENUE model is a departure from reality which was a necessary part of the simulation methodology. In section 2 of part IV where zero volume growth was assumed the effect is that the farmer's WGTA cost is overstated by, at most, 8%, 20%, and 28% in 1985/86, 1990/91 and 1995/96 respectively.

It should also be mentionned that the WGTA tariffs used throughout this report are based entirely on a single car rate and do not incorporate the possible impact on costs of bulk discounts negotiable through variable rates for multiple car contracts, off-season shipments, rapid loading, etc.

TABLE 4A

6.8% FORECAST COST DISTRIBUTION
(average $/1 000 bushels)

STUDY AREA	1977-78	1981-82	1985-86	1990-91	1995-96
Manitoba:					
-Trucking	34	54	69	90	119
-Elevation	132	192	253	343	483
-WGTA Tariff	93	93	556	777	983
Total	259.0	339.0	878.0	1210.0	1585.0
Saskatchewan 1:					
-Trucking	42	60	76	100	132
-Elevation	128	207	272	369	520
-WGTA Tariff	130	130	776	1083	1363
Total	300.0	397.0	1124.0	1552.0	2015.0
Saskatchewan 2:					
-Trucking	31	48	61	80	105
-Elevation	146	240	314	427	601
-WGTA Tariff	137	137	819	1144	1447
Total	314.0	425.0	1194.0	1651.0	2153.0
Alberta:					
-Trucking	34	48	62	81	106
-Elevation	193	210	276	375	528
-WGTA Tariff	108	108	648	899	1118
Total	335.0	366.0	986.0	1355.0	1752.0
Prairie Average (simple average of available data shown above):					
-Trucking	35	52	67	88	116
-Elevation	150	212	279	378	533
-WGTA Tariff	117	117	700	976	1228
Total	302.0	381.8	1045.5	1442.0	1876.2

Notes:

1. See text for detailed explanation on cost inflation forecast.
2. Trucking and elevation costs reflect GDP forecast at 7.5% over 1977-1996 and 6.8% over 1982-1996.

TABLE 4B

6.8% FORECAST COST DISTRIBUTION
(in % of each study area's total)

STUDY AREA	1977-78	1981-82	1985-86	1990-91	1995-96
Manitoba:					
-Trucking	13	16	8	7	8
-Elevation	51	57	29	28	30
-WGTA Tariff	36	27	63	64	62
Total	100.0	100.0	100.0	100.0	100.0
Saskatchewan 1:					
-Trucking	14	15	7	6	6
-Elevation	43	52	24	24	26
-WGTA Tariff	43	33	69	70	68
Total	100.0	100.0	100.0	100.0	100.0
Saskatchewan 2:					
-Trucking	10	11	5	5	5
-Elevation	46	56	26	26	28
-WGTA Tariff	44	32	68	69	67
Total	100.0	100.0	100.0	100.0	100.0
Alberta:					
-Trucking	10	13	6	6	6
-Elevation	58	57	28	28	30
-WGTA Tariff	32	30	66	66	64
Total	100.0	100.0	100.0	100.0	100.0
Prairie Average (simple average of available data shown above):					
-Trucking	12	14	6	6	6
-Elevation	49	56	27	26	28
-WGTA Tariff	39	30	67	67	65
Total	100.0	100.0	100.0	100.0	100.0

Note:

1. Slight variation year-to-year is due to rounding.

TABLE 4C

3.4% FORECAST COST DISTRIBUTION
(average $/1000 bushels)

STUDY AREA	1977-78	1981-82	1985-86	1990-91	1995-96
Manitoba:					
-Trucking	34	54	69	89	116
-Elevation	132	192	221	258	307
-WGTA Tariff	93	93	556	777	983
Total	259.0	339.0	846.0	1124.0	1406.0
Saskatchewan 1:					
-Trucking	42	60	76	98	129
-Elevation	128	207	236	278	331
-WGTA Tariff	130	130	776	1083	1363
Total	300.0	297.0	1088.0	1459.0	1823.0
Saskatchewan 2:					
-Trucking	31	48	61	79	102
-Elevation	146	240	275	321	383
-WGTA Tariff	137	137	819	1144	1447
Total	314.0	425.0	1155.0	1544.0	1932.0
Alberta:					
-Trucking	34	48	61	79	103
-Elevation	193	210	242	282	336
-WGTA Tariff	108	108	648	899	1118
Total	335.0	366.0	951.0	1260.0	1557.0
Prairie Average (simple average of available data shown above):					
-Trucking	35	52	67	86	112
-Elevation	150	212	244	285	339
-WGTA Tariff	117	117	700	976	1228
Total	302.0	381.8	1010.0	1346.8	1679.5

Notes:
1. See text for detailed explanation on cost inflation forecast.
2. Trucking and elevation costs reflect GDP forecast at 3.4% over 1982-1996.

TABLE 4D

3.4% FORECAST COST DISTRIBUTION
(in % of each study area's total)

STUDY AREA	1977-78	1981-82	1985-86	1990-91	1995-96
Manitoba:					
-Trucking	13	16	8	8	8
-Elevation	51	57	26	23	22
-WGTA Tariff	36	27	66	69	70
Total	100.0	100.0	100.0	100.0	100.0
Saskatchewan 1:					
-Trucking	14	15	7	7	7
-Elevation	43	52	22	19	18
-WGTA Tariff	43	33	71	74	75
Total	100.0	100.0	100.0	100.0	100.0
Saskastchewan 2:					
-Trucking	10	11	5	5	5
-Elevation	46	56	24	21	20
-WGTA Tariff	44	32	71	74	75
Total	100.0	100.0	100.0	100.0	100.0
Alberta:					
-Trucking	10	13	6	6	7
-Elevation	58	57	25	22	22
-WGTA Tariff	32	30	68	71	72
Total	100.0	100.0	100.0	100.0	100.0
Prairie Average (simple average of available data shown above):					
-Trucking	11	14	7	6	7
-Elevation	49	56	24	21	20
-WGTA Tariff	40	30	69	72	73
Total	100.0	100.0	100.0	100.0	100.0

Note: Slight variation year-to-year is due to rounding.

2.1 Impact of Delivery Volume Increases

To derive the impact of a 28% delivery increase by all farmers we can use the following approach. From Figure 2 one might conclude any increase in deliveries would increase trucking and rail tariff costs proportionately; this is true only for rail. In the case of trucking, the average unit operating cost per bushel mile drops with increased vehicle utilization resulting in a less than proportional rise in total cost for any rise in grain volume transported. The nature of the cost model makes it difficult to directly estimate "by how much" truck cost would increase for any rise in shipments. Since the trucking cost is a minor element of the total cost to the farmer, an adequate estimate of the total impact can be found even if we assume a **WORST** case and let trucking cost increase a full 28%.

Regarding rail charges, a 28% rise in shipments means a 28% rise in that cost to farmers.

In the case of elevation cost, delivery increases only affect operating costs which vary with grain receipts. Allowing for inflation, in 1995/6 this means 23 cents per additional bushel. Fixed and allocated operating costs are unaffected. The sample areas generated 61.3 million bushels in 1981/2 and we estimate 28% growth (17 million bushel) will add 4 million dollars in operating costs. The new total deliveries of 79 million bushels will cost 39 million dollars or $468 per kilo-bushel, down 11% from the $533 average first derived. The 28 per cent delivery increase would cause the alternate cost distribution shown in line 2 of Table 5.

TABLE 5

1995/96 COST DISTRIBUTION ALTERNATIVES
(in $/1 000 bushels)

		Trucking	Elevation	WGTA	Total
1.	1981/82 Volumes in 1995-96 dollars:	116	533	1228	1876
	% Distribution:	6%	28%	65%	100%
2.	Ag. Canada Volumes in 1995-96 dollars:	148	468	1572	2188
	% Distribution:	7%	21%	72%	100%
3.	Change (1./2.):	+28%	-11%	+28%	+17%

Note: Based on GDP inflation rate of 6.78%.

In summary, farmers who do increase their deliveries by 28% will, in contrast to farmers who do not, pay 17% more for a total of $2188 per kilo-bushel in 1995/96 to move their grain. The difference in cost forecasts under these two scenarios is only a 7% shift from elevation-related to WGTA tariff-related costs of farmers. The 1995 WGTA tariff being increased eleven-fold will clearly dominate the other cost components; and in conclusion, one can expect the WGTA tariff charges by 1995/96 will represent at least 68 per cent of a farmer's costs.

3. Crow Benefit Forecast

Since the PHAER system can estimate the magnitude of WGTA revenues and the railway cost of moving grain a comparison of the two estimates, or more specifically the difference between them, has some usefulness. Their difference represents a sort of local Crow Benefit, that is at the farm/elevator level. Note this definition is specific to the purposes of the study and is not to be mistaken for the more common definition in the

legislation which refers to federal subsidy commitment of some 658 million dollars per year. While it was outside the terms of reference for this study, a calculation of trends for the local Crow Benefit is illustrated below. Legislation fixes the part of the rate of inflation shippers will pay for. So depending upon the inflation trend that will actually occur and its affect on carriers' costs, the grain shipper's WGTA cost, i.e. the carriers' tariff revenue, will either move towards or away from becoming full compensatory rates. Regardless, farmers will still pay more, in absolute terms.

Tables 6A and 6B illustrate the forecast of average rail operating cost per kilo-bushel to actually move the grain by rail to port position, as measured from the railway company perspective. These estimates presume in each forecast year 31.5 million tonnes will be shipped and incorporate the assumed inflation rate of 6.78% (in 6A) and 3.39% (in 6B).

The forecast of the WGTA tariffs used in this study incorporates the assumption that shippers will pay annually all of, but not move than, 5 % inflation in costs.

Tables 7A and 7B illustrate the forecast differential between what farmers pay for rail service and its cost, a Crow Benefit, under the two inflation trend assumptions. Figures 7A and 7B chart the cost distribution the farmer will experience as well as the rail operating costs to better illustrate the Crow Benefit in each scenario. The Crow Benefit in each chart is the margin between the cost element labelled 'Farmer's WGTA Cost' and the railway operating cost. The chart highlights better than any table the differential over the 1977-1995 years between the farmer's cost and the railway companies'. For an inflation trend of 6.78% the total farm grain handling and transportation cost for each year will be less than the estimate railway's of the operating cost. Under the assumption that inflation to which the railway companies are subjected will be as low as 3.39% the railway operating cost falls below total farm costs and more importantly railway cost could be nearly equal to railway WGTA revenue by 1995.

TABLE 6A

RAIL OPERATING COSTS AT 6.78% INFLATION
(average $/kilo-bushels)

STUDY AREA	Crop Year Forecast				
	1977	1981	1985	1990	1995
Manitoba	293	567	744	1009	1421
Saskatchewan					
Area 1	479	831	1089	1479	2082
Area 2	622	1319	1729	2346	3304
Alberta	316	473	621	843	1187
Prairie Average	428	798	1046	1419	1999

TABLE 6

RAIL OPERATING COSTS AT 3.39% INFLATION
(average $/kilo-bushels)

STUDY AREA	Crop Year Forecast				
	1977	1981	1985	1990	1995
Manitoba	293	567	651	760	905
Saskatchewan					
Area 1	479	831	954	1114	1326
Area 2	622	1319	1514	1767	2103
Alberta	316	473	544	635	755
Prairie Average	428	798	916	1069	1272

Note: The estimates above were prepared by Freight Studies, CTC Research Branch, according to the process defined in the text. In no manner shall these estimates be construed as representing the opinions of the Railway Transport Committee.

TABLE 7A

ESTIMATED CROW BENEFIT AT 6.78% INFLATION
(in $/1000 bushels)

Crop Year	Average Railway		Crow Benefit	
	Tariff Charge (Rail Revenue	Operating Cost	In $	Ratio of C.B./Revenue
1977/78	117	428	311	2.66
1981/82	117	798	681	5.82
1985/86	700	1046	346	.49
1990/91	976	1419	443	.45
1995/96	1228	1999	771	.63

Note: Rail tariff data is from Table 4A, operating cost data is from Table 6A.

TABLE 7B

ESTIMATED CROW BENEFIT AT 3.39% INFLATION
(in $/1 000 bushels)

Crop Year	Average Railway		Crow Benefit	
	Tariff Charge (Rail Revenue)	Operating Cost	In $	Ratio of C.B./Revenue
1977/78	117	428	311	2.66
1981/82	117	798	681	5.82
1985/86	700	916	216	.31
1990/91	976	1069	93	.10
1995/96	1228	1272	44	.04

Note: Rail tariff data is from Table 4B, operating cost data is from Table 6B.

Figure 7a

COMPARISON OF AVERAGE FARMER'S OUT OF POCKET COSTS AND RAILWAY'S OPERATING COST BY CROP YEAR (assumes 6.78% inflation)

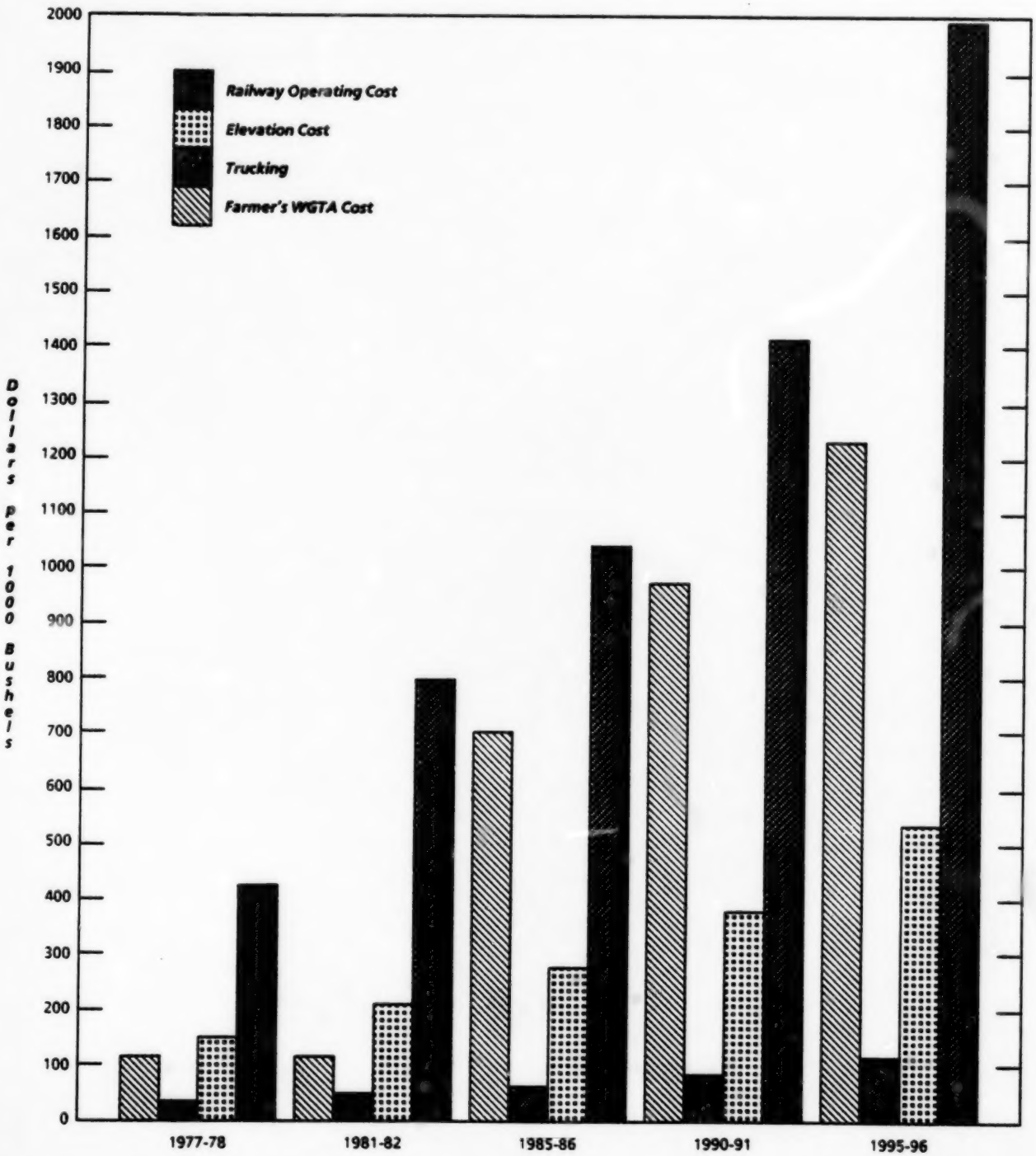
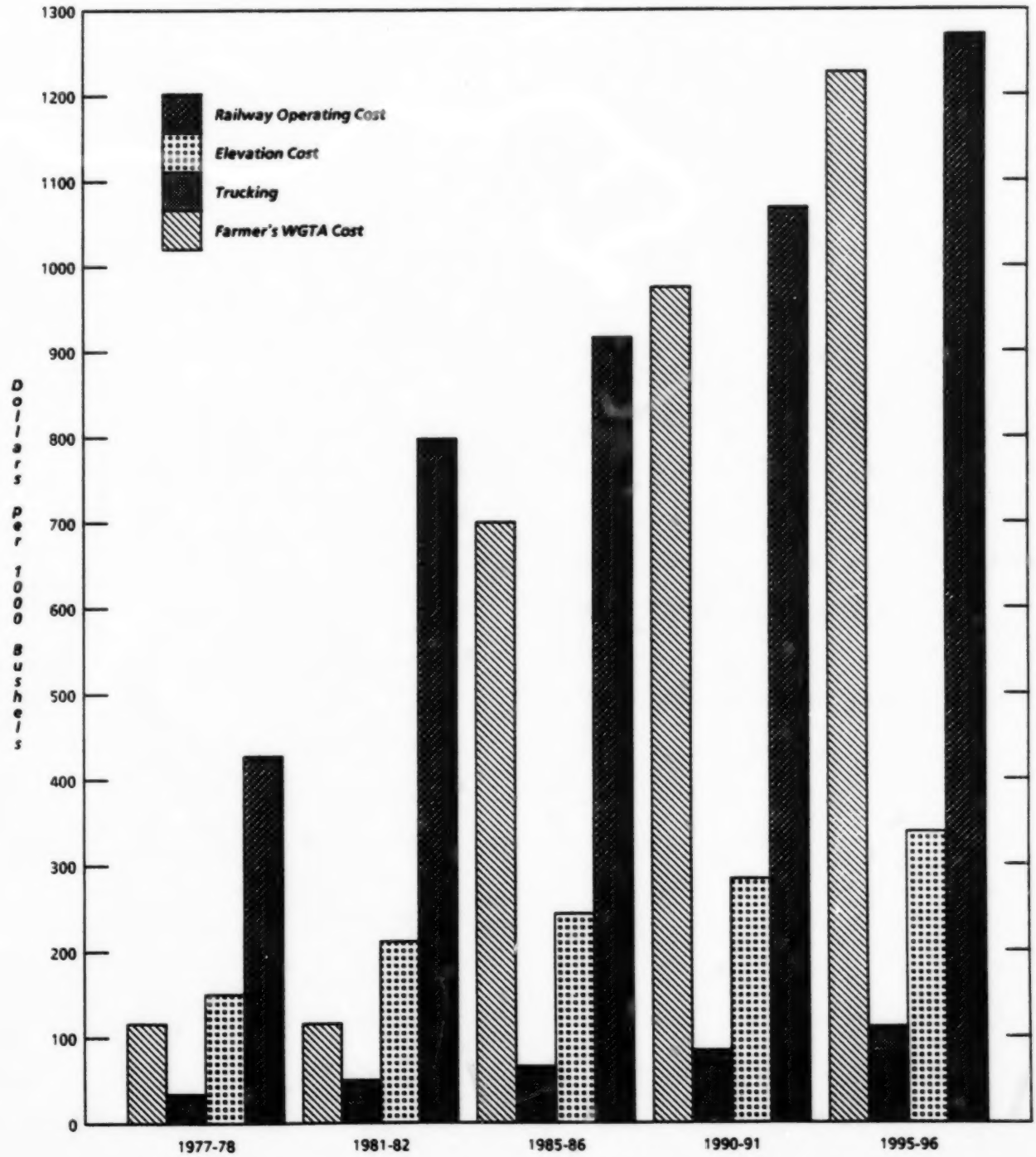


Figure 7b

COMPARISON OF AVERAGE FARMER'S OUT OF POCKET COSTS AND RAILWAY'S OPERATING COST BY CROP YEAR (assumes 3.39% inflation)



APPENDIX 1

ASSUMPTIONS USED IN COSTING MODELS

1. TRUCKING COST MODEL

   .1 The vast majority of farmers use their own trucks, custom and commercial trucking is minor occurrence.

   .2 Average truck paylod is 7.5 tons, age is 10.2 years, annual utilization is 12,000 kilometers.

   .3 Petroleum product prices will increase 3.9% annually.

   .4 Labor wage rates will increase 4.7% annually.

   .5 Farm truck prices will inflate 9.4% annually.

   .6 Costs for miscellaneous truck items will inflate at same rate as Gross Domestic Product.

2. ELEVATION COST MODEL

   .1 All costs of elevator operation will inflate at same rate as GDP.

   .2 Unit elevator costs are essentially equal to grain handling service tariffs due to competition.

3. RAILWAY OPERATING COST MODEL

   .1 Sames 2.1 above.

4. WGTA TARIFF COST MODEL

   .1 Shipments will increase 28 % by 1995/96 over 1981/82 volumes.

   .2 Shippers share of rate of cost changes is 100 %.

   .3 Rate of cost inflation is a steady 5 % per year.

APPENDIX 2

STUDY AREA CHARACTERISTICS

Province: Alberta Crop Year 1981-82

Factors	Provincial Stats	Study Area[3] Stats	Study Area/Province
Throughput ratio	3.0	2.8	.93
Elevator companies	10	6	n.a.
No. of elevators	1 054	86	8.2%
Permit holders[1]	47 498	2246	4.7%
No. of delivery points	365	25	6.8%
Avg. Truck Haul Distance (miles)	14.9 (1/2 10.9)	9.8 (est.)	n.a.
Deliveries	9 754 000 tonnes	590 400 tonnes	6.0%
Capacity	3 281 200 tonnes	212 900 tonnes	6.5%
Avg. throughput per producer	7 335 bu.	9 388 bu.	1.28
Deliveries by grain type (as % of total)[2]	(1) 46 (2) 4.5 (3) 3 (4) 40 (5) 2 (6) 0 (7) 5	(1) 50 (2) 6.4 (3) 1 (4) 36 (5) 6 (6) 1 (7) 2.3	n.a.

1 Includes North East of British Columbia (Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics).

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area consist of the Lomond subdv., the Macleod subdv. plus a portion of the Aldersyde subdv. linking Macleod to Lomond.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

Province: Manitoba Crop Year 1981-82

Factors	Provincial Stats	Study Area[3] Stats	Study Area/Province
Throughput ratio	3.2	3.45	.09
Elevator companies	10	7	n.a.
No. of elevators	387	40	10.3%
Permit holders[1]	25 401	2 615	10.3%
No. of delivery points	216	15	6.9%
Avg. Truck Haul Distance (miles)	14.0 (1/2 9.3)	11.4 (est.)	n.a.
Deliveries	4 611 500 tonnes	491 603 tonnes	10.7%
Capacity	1 463 340 tonnes	142 516 tonnes	9.7%
Avg. throughput per producer	6 484 bu.	6 714 bu.	1.04
Deliveries by grain type (as % of total)[2]	(1) 56 (2) 3.5 (3) 1.7 (4) 28 (5) 2.7 (6) 4 (7) 3.4	(1) 54 (2) 6 (3) 1 (4) 28 (5) 2 (6) 7 (7) 3	n.a.

1 Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics.

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area consist of the Napinka subdv. plus a portion of the La Rivière subdv. from la Rivière to Plum Coulee.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

Province: Saskatchewan Crop Year 1981-82

Factors	Provincial Stats	Study Area[3] A	Area A/ Prov.	Study Area[4] B	Area B/ Prov.
Throughput ratio	3.1	3.2	1.03	2.35	.76
Elevator companies	9	4	n.a.	3	n.a.
No. of elevators	1 712	32	1.9%	35	2.0%
Permit holders[1]	71 115	1 415	2.0%	920	1.3%
No. of delivery points	619	10	1.6%	10	1.6%
Avg. Truck haul distance (miles)	12.9 (1/2 9.1)	12.7 (est.)	n.a.	9.5 (est.)	n.a.
Deliveries	14 746 100 tonnes	355 400 tonnes	2.4%	238 400 tonnes	1.6%
Capacity	4 794 600 tonnes	110 180 tonnes	2.3%	101 710 tonnes	2.1%
Avg. throughput per producer	7 406 bu.	8 970 bu.	1.21	9 255 bu.	1.25
Deliveries by grain type (as % of total)[2]	(1) 66 (2) 13.6 (3) 1 (4) 14 (5) 1.6 (6) 1 (7) 3.3	(1) 69 (2) 9.5 (3) 1 (4) 17.5 (5) 1 (6) 1 (7) 3	n.a.	(1) 51 (2) 37 (3) 1 (4) 10.6 (5) 1 (6) 1 (7) 1	n.a.

1 Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics.

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area A consist of: the Macklin subdv., the Kerrobert subdv. plus the Dodsland and the Rosetown delivery points.

4 Study Area B consist of: the Mantario subdv. from Mantario to Eston (incl.) and the White Bear subdv.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

Province: Alberta Crop Year 1977-78

Factors	Provincial Stats	Study Area[3] Stats	Study Area/Province
Throughput ratio	1.85	1.43	.77
Elevator companies	10	6	n.a.
No. of elevators	1 246	100	8.0%
Permit holders[1]	48 165	1 956	4.1%
No. of delivery points	406	26	6.4%
Avg. Truck Haul Distance[4] (miles)	14.7 (1/2 10.1)	9.9 (est.)	n.a.
Deliveries	6 595 400 tonnes	358 900 tonnes	5.4%
Capacity	3 569 970 tonnes	250 980 tonnes	7.0%
Avg. throughput per producer	4 845 bu.	6 553 bu.	1.35
Deliveries by grain type (as % of total)[2]	(1) 51 (2) 2.4 (3) 3.8 (4) 34.2 (5) 1.1 (6) 0.5 (7) 7.1	(1) 56.6 (2) 3.3 (3) 0.5 (4) 30.7 (5) 3.3 (6) 2.0 (7) 3.6	n.a.

1 Includes North East of British Columbia (Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics).

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area consist of the Lomond subdv., the Macleod subdv. plus a portion of the Aldersyde subdv. linking Macleod to Lomond.

4 Estimates for 1978/79 crop year.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

Province: Manitoba Crop Year 1977-78

Factors	Provincial Stats	Study Area[3] Stats	Study Area/Province
Throughput ratio	2.8	3.7	1.32
Elevator companies	9	5	n.a.
No. of elevators	466	42	9.0%
Permit holders[1]	27 767	2 366	8.5%
No. of delivery points	253	16	6.3%
Avg. Truck Haul Distance[4] (miles)	13.8 (1/2 9.2)	10.9 (est.)	n.a.
Deliveries	4 360 600 tonnes	433 900 tonnes	10.0%
Capacity	1 548 310 tonnes	117 380 tonnes	7.6%
Avg. throughput per producer	5 609 bu.	6 550 bu.	1.17
Deliveries by grain type (as % of total)[2]	(1) 56 (2) 1.2 (3) 6.1 (4) 25.8 (5) 1.4 (6) 6.0 (7) 3.7	(1) 53 (2) 1.7 (3) 3.1 (4) 28.6 (5) 1.1 (6) 9.6 (7) 2.7	n.a.

1 Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics.

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area consist of the Napinka subdv. plus a portion of the La Rivière subdv. from la Rivière to Plum Coulee.

4 Estimates for 1978/79 crop year.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

Province: Saskatchewan Crop Year 1977-78

Factors	Provincial Stats	Study Area[3] A	Area A/ Prov.	Study Area[4] B	Area B/ Prov.
Throughput ratio	3.0	3.3	1.10	2.45	.82
Elevator companies	9	4	n.a.	3	n.a.
No. of elevators	2 038	37	1.8%	40	2.0%
Permit holders[1]	74 114	1 203	1.6%	874	1.2%
No. of delivery points	751	10	1.3%	10	1.3%
Avg. Truck haul distance[5] (miles)	12.7 (1/2 9.1)	15.9 (est.)	n.a.	8.9 (est.)	n.a.
Deliveries	15 632 400 tonnes	375 300 tonnes	2.4%	274 600 tonnes	1.8%
Capacity	5 244 790 tonnes	114 150 tonnes	2.2%	112 020 tonnes	2.1%
Avg. throughput per producer	7 533 bu.	11 142 bu.	1.48	11 221 bu.	1.49
Deliveries by grain type (as % of total)[2]	(1) 72.4 (2) 10.4 (3) 1.3 (4) 10.8 (5) 0.7 (6) 1.1 (7) 3.3	(1) 72 (2) 6.6 (3) 0.5 (4) 16.6 (5) 0 (6) 2.6 (7) 1.5	n.a.	(1) 63 (2) 24.1 (3) 0.1 (4) 10.5 (5) 0 (6) 2.4 (7) 0	n.a.

1 Source: Canadian Wheat Board, Seeded and Quota Acreage Statistics.

2 Grain type codes refer to (1) Wheat (2) Durum (3) Oats (4) Barley (5) Rye (6) Flax (7) Rapeseed.

3 Study Area A consist of: the Macklin subdv., the Kerrobert subdv. plus the Dodsland and the Rosetown delivery points.

4 Study Area B consist of: the Mantario subdv. from Mantario to Eston (incl.) and the White Bear subdv.

5 Estimates for 1978/79 crop year.

All figures from Canadian Grain Commission publications unless otherwise stated.

est.: estimate

n.a.: not applicable

STUDY AREAS

1- Length of haul on branch line before reaching main line is:

Alberta	:	avg. 48 miles
Manitoba	:	avg. 93 miles
Sask. (Study Area A)	:	avg. 50 miles if all shipments go west avg. 83 miles if some shipments go east.
(Study Area B)	:	avg. 53,8 miles.

2- Length of haul from delivery points to Port:

Alberta	:	667 to 802 miles (to Vancouver)
Manitoba	:	482 to 631 miles (to Thunder Bay)
Sask.	:	Kerrobert/Macklin 963 to 1 036 (Vanc. & Th. Bay) Mantario/White Bear 927 to 998 (Vancouver).

3- Farms in study areas are:

Alberta	:	within 1 to 40 miles from main line or secondary main line.
Manitoba	:	are within 1 to 50 miles.
Sask.	:	(Kerrobert/Macklin) 1 to 30 miles from main line (Mantario White Bear) 1 to 35 miles from secondary main line (Rosetown).

4- Total delivery points for sample areas:

60 in 81/82
(58 in 83/84, 62 in 77/78).

APPENDIX 3

Summary of Cost and Traffic Inflation Factors

APPENDIX 3

SUMMARY OF COST AND TRAFFIC INFLATION FACTORS

Factor	Crop Year Forecast					Annual Growth Trend	
	1977-78	1981-82	1985-86	1990-91	1995-96	1977-82	1982-96
Trucking Cost Model:							
1.1 Petroleum Price Index	.518	1.000	1.198	1.399	1.717	17.87	3.94
1.2 Labor Wage Index	.751	1.000	1.262	1.581	1.901	7.42	4.70
1.3 Truck Price Index	.698	1.000	1.435	2.250	3.529	9.40	9.43
1.4 General Price Index (uses GDP as proxy)							
Assuming 6.78% trend	.682	1.000	1.311	1.779	2.505	8.00	6.78
Assuming 3.39% trend	.682	1.000	1.148	1.340	1.595	8.00	3.39
Elevation Cost Model:							
2.1 General Price Index (uses GDP as proxy)							
Assuming 6.78% trend	.682	1.000	1.311	1.779	2.505	8.00	6.78
Assuming 3.39% trend	.682	1.000	1.148	1.340	1.595	8.00	3.39
WGTA Tariffs Forecast:							
3.1 Crow Multiplier (ref. 3.2 below)	1.00	1.00	5.99	8.36	10.58	-	18.35
3.2 Ag. Canada Forecast of total tonnes shipped under WGTA							
(million tonnes)		31.50	33.70	37.70	40.60	-	1.83
Railway Operating Cost Model:							
4.1 General Cost Index (for online and offline cost)							
Assuming 6.78% trend	.682	1.000	1.311	1.779	2.505	8.00	
Assuming 3.39% trend	.682	1.000	1.148	1.340	1.595	8.00	

Notes:

1. Source of forecasts:

1.1	National Energy Board projection (Oct. 1984)
1.2, 1.3	Extrapolation of Stats. Canada price time series data to 1984.
1.4, 2.1, 4.1	Transport Canada Economic Analysis Div. provided Gross Domestic Product (GDP) forecast, it has average change of 7.5% per year over 1977-96.

2. Implicit in 3.1 is Ag. Canada grain production/shipment forecast in 3.2.